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Concentration and flux of wind-blown snow

Malcolm Mellor and Gregor Fellers

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Representative graphical relations are developed for the flux and concentration of wind-blown snow as functions of wind speed and height above surface. Previously published field data are tabulated to provide 1201 data sets for flux and the same number for mass concentration. Using appropriately transformed variables, multiple regression analysis yields empirical relations for horizontal mass flux as a function of wind speed and height, and for mass concentration as a function of wind speed and height.

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PREFACE

This report was prepared by Dr. Malcolm Mellor, Research Physical Scientist, Experimental Engineering Division, and Gregor Fellers, Computer Specialist, Engineering and Measurement Services Branch, Technical Services Division, U.S. Army Cold Regions Research and Engineering Laboratory. The work was supported as part of DA Project 4A762730AT42, Design, Construction, and Operations Technology for Cold Regions, Task Area BS (Base Support), Work Unit 044, Control of Snowdrifting and Ice Accretion.

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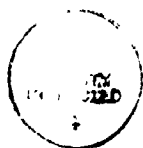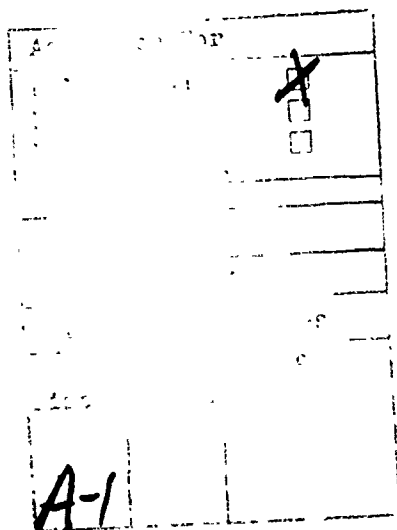
CONCENTRATION AND FLUX OF WIND-BLOWN SNOW

Malcolm Mellor and Gregor Fellers

Information on the mass concentration and the horizontal mass flux of blowing snow is useful in dealing with certain practical problems, notably those involving snowdrift formation, wind tunnel (or water flume) modeling of blowing snow, reduction of visibility, and attenuation of radiation near optical frequencies. The basic requirement is for data on the concentration and flux as functions of height and wind speed when the wind blows across a flat surface with an ample supply of loose snow particles.

Many years ago, Australian investigators working in Antarctica gathered a large quantity of systematic data on blowing snow, using techniques and equipment that were validated by tests and theory. Results were analyzed very thoroughly, with emphasis on establishment of the relevant physics. Without doing anything essentially different from the original investigators, we have combined the Australian data and applied multiple regression analysis in order to relate mass flux and mass concentration to the relevant variables that are most easily measured, i.e. height above surface, and wind speed at standard anemometer height.

The Australian studies were inspired by Fritz Loewe, whose interest in blizzards was stimulated by a wintering in Terre Adélie. Systematic observations were originated by M. Mellor and developed under the direction of U. Radok. The great majority of the field observation were made by R. Dingle, and analyzed by U. Radok and W. Budd. Anemometers and aerodynamic snow collectors were mounted in pairs on vertical masts, with logarithmic vertical spacing. At each level, the instruments gave wind speed and mass flux. Mass concentration and the parameters of the wind profile (shear velocity and roughness height) could then be derived. Altogether, 1201 usable data sets were obtained (see Appendix). They include measurements in conditions where: (a) there is new snow falling directly into the turbulent boundary layer, and (b) there is no precipitation from above and all particles are picked up from the surface. Most of the observational

data have been published (Budd et al. 1965, Mellor and Radok 1960), but some unpublished results were provided directly by Dingle and Radok. Information on particle size and fall velocity can be found elsewhere (Budd 1965, Budd et al. 1965, Mellor 1965); with strong winds (> 10 m/s) mean particle size is approximately 100 μm around 1 m height, about 150-200 μm within a few centimetres of the surface, and about 90 μm at head height.

Measurements have been made by other investigators, but we do not have access to the actual observational data, or to the instrument calibrations that are needed to establish comparability.

To obtain representative empirical relations for the dependence of flux q and concentration ρ on height z and wind speed u_{10}, we can perform multiple regression analysis on the data while taking account of the relevant physics. The dependent variable Y is a simple function of either q or ρ, and it is expressed initially as a 10-term polynomial with cross-products and terms up to the third power. Some terms may be discarded on the basis of significance tests. The two independent variables X_1 and X_2 are simple functions of z and u_{10} respectively. If Y is taken directly as ρ, with X_1 and X_2 as z and u_{10} respectively, the correlation is very poor, since the observed values of Y range over more than 4 orders of magnitude, while corresponding values of X_1 range over more than 2 orders of magnitude. Using the logarithms of the observed quantities for Y and X_1, together with u_{10} as X_2, the results are much better. However, both theory and observation (Dingle and Radok 1961, see also Budd et al. 1965 and Mellor 1965) indicate that the relation between ln ρ and the reciprocal of wind speed, $1/u_{10}$, should be close to linear, and it is found that regression of ln ρ (Y) against ln z (X_1) and $1/u_{10}$ (X_2) gives the best fit to the data.

A parallel treatment for the regression of ln q against ln z and $1/u_{10}$ is less easy to relate to theory. However, by using different forms of the wind profile in the expressions for ρ and u in the product q = ρu, the logarithmic regression forms for q and z can be justified (see Mellor 1965, p. 15, eq 17). By comparing magnitudes for the two parts of the exponent in the hybrid equation for q, it can be argued that the wind-dependence of q is not radically different from that of ρ, so that there can be no strong objection to taking X_2 as $1/u_{10}$ in the regression.

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In both regressions the multiple correlation coefficient $r = 0.978$. The standard error of Y about the regression plane is 0.453 for ln ρ and 0.447 for ln q (with ρ and q in units of g/m^3 and g/m^2-s respectively).

The final regression equations were as follows.

<u>Mass flux, q</u>

$Y = \ln q$, $X_1 = \ln z$, $X_2 = 1/u_{10}$.   (q in g/m^2-s, z in m, u_{10} in m/s)

$Y = 10.089 - 0.41049\ X_1 - 122.03\ X_2 - 0.13856\ X_1^2 - 14.446\ X_1X_2$

$\quad - 0.0059773\ X_1^3 + 3.2682\ X_1^2X_2 + 114.13\ X_1X_2^2 + 2290.0\ X_2^3$

<u>Mass concentration, ρ</u>

$Y = \ln \rho$, $X_1 = \ln z$, $X_2 = 1/u_{10}$.   (ρ in g/m^3, z in m, u_{10} in m/s)

$Y = 4.8679 - 0.42209\ X_1 - 34.369\ X_2 - 0.13265\ X_1^2 - 17.427\ X_1X_2$

$\quad - 972.01\ X_2^2 - 0.0070277\ X_1^3 + 3.2692\ X_1^2X_2 + 135.54\ X_1X_2^2$

$\quad + 6430.2\ X_2^3$

Figure 1 shows probable values of mass concentration ρ as a function of height z and wind speed u_{10} according to the regression equation. In Figure 1a, ρ is plotted against z on logarithmic scales, with u_{10} as parameter. In Figure 1b, ρ is plotted on a logarithmic scale against $1/u_{10}$ (or against u_{10} on a distorted scale), with z as parameter. The observational range for z was from 0.03 to 4 m, and for u_{10} it was mainly within the range 10 to 25 m/s, with a few values up to 36 m/s.

For high wind speeds, when particles are well diffused, Figure 1a indicates that the theoretical power relation between ρ and z is a good approximation, with an exponent not far from -1. The exponent given by simple theory is $-w/ku_*$, where w is particle fall velocity, u_* is shear velocity ($\approx$ 1 m/s with winds of 25–35 m/s), and k is von Karman's constant (0.4). If $-w/ku_* \approx -1$ for strong winds, $w \approx 0.4$ m/s, which is a credible value for particles of wind-blown snow.

At low wind speeds, when there is a sorting of particle size (and fall velocity) with height (see Budd 1965), a linear relation between ln ρ and ln z applies only at low levels. At the lowest observed wind speeds ($\approx$ 10 m/s), ρ tends to a limit of about 0.06 g/m^3 when z is greater than a few metres. This is the sort of concentration that corresponds to very light snowfall in calm weather. At the lower levels, the general (negative)
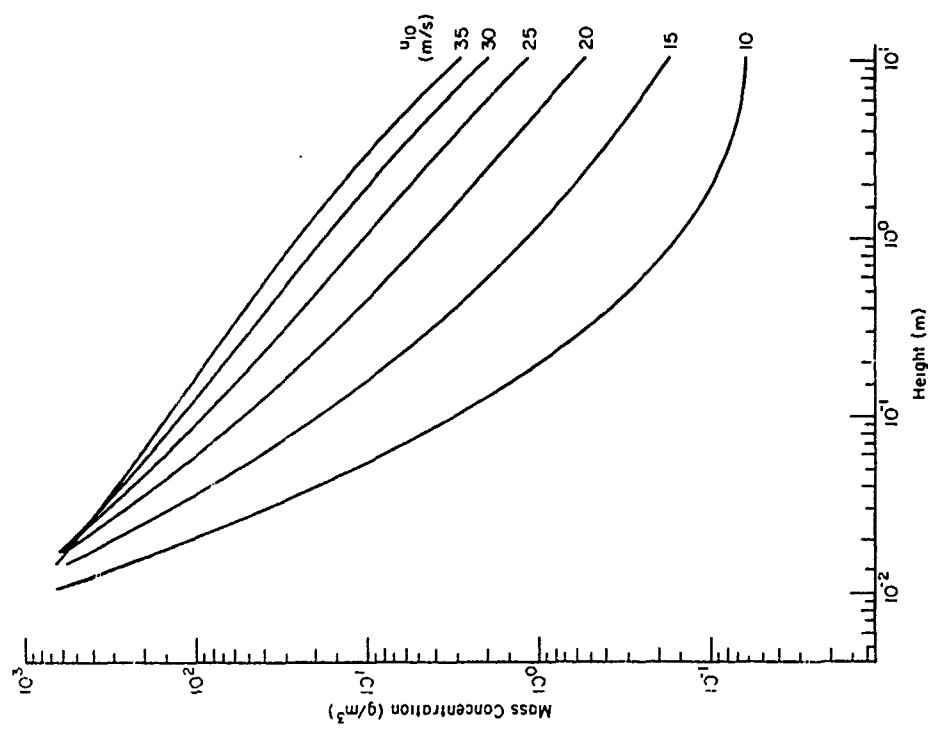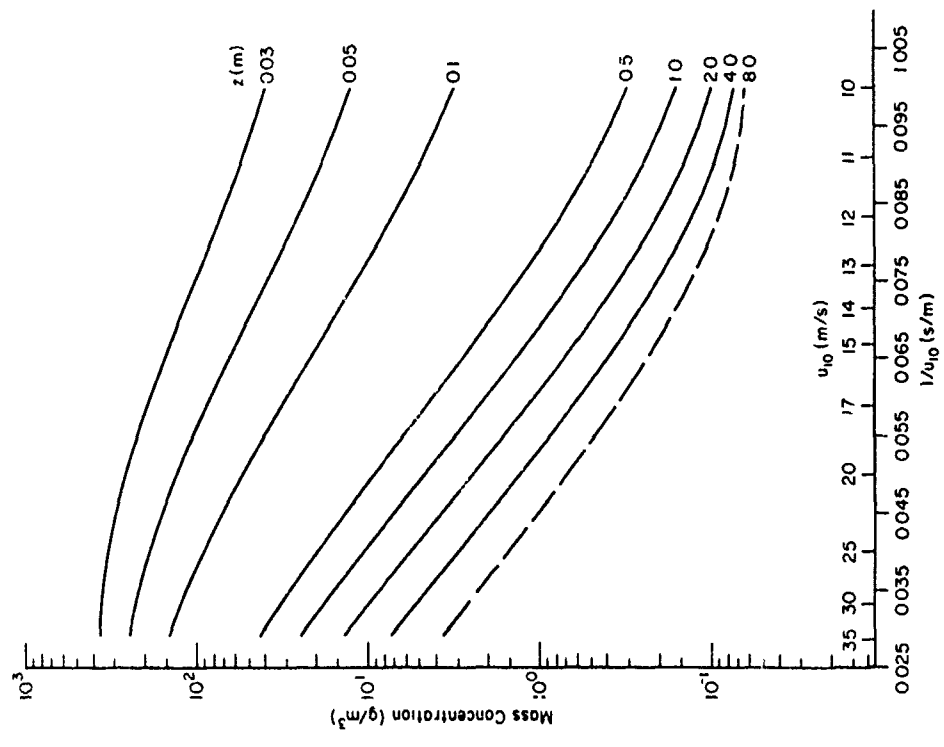
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b. ρ (logarithmic scale) plotted against $1/u_{10}$ (linear scale) and u_{10} (distorted scale), with z as parameter. The line for z = 8 m is broken because the highest measuring level was z = 4 m.

a. ρ plotted against z on logarithmic scales, with u_{10} as parameter.

Figure 1. Probable values of mass concentration ρ as a function of height z and wind speed u_{10}.

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slope of the curves in Figure 1a increases as u_{10} decreases, presumably because the shear velocity is proportional to u_{10}. Very close to the ground ($z \approx 10$ mm), the curves converge to a focus, indicating an upper limit of concentration that is not strongly dependent on wind speed. This limit, which is approximately 1400 g/m^3 and therefore close to air density (≈ 1300 g/m^3), was predicted and noted in earlier studies (Owen 1964, Budd et al. 1965, Greeley and Iversen 1985). The height of the "focus" is more or less the height of the top of the saltation layer.

Figure 1b shows that the theoretical expectation of inverse proportionality between $\ln \rho$ and $1/u_{10}$ is realized in strong winds at levels above 0.5 m. However, with less strong winds the concentration does not decrease as much as might be expected from simple theory, perhaps because falling snow sets a lower limit for ρ. At low levels, ρ becomes progressively less sensitive to wind speed, as already mentioned in connection with the "focus" in Figure 1a. The curves for low levels in Figure 1b could perhaps be approximated by straight lines, but they actually show contraflexure. Taken at face value, they suggest that ρ may become almost independent of u_{10} for very high winds and for layers very close to the surface, a trend which seems credible. They also indicate a trend towards a lower limit of ρ in light winds for layers very close to the surface. This is more difficult to rationalize, although one might consider systematic change in particle size as a possible explanation.

Figure 2 gives horizontal mass flux q as a function of height z and wind speed u_{10}. The plot of $\ln q$ against $\ln z$ (Fig. 2a) shows approximate linearity for high wind speeds, with the relation not too far from inverse proportionality. In lighter winds, an approximately linear relation between $\ln q$ and $\ln z$ prevails only at low levels. At high levels and low wind speeds, q for a given value of z tends towards a limit. As was the case for ρ, the curves in Figure 2a tend to suggest convergence to a focus very close to the surface, but it is not easy to accept this trend. Extension of the curves to a common point indicates q $\approx$ 30,000 g/m^2-s at z $\approx$ 6 mm. However, the limiting value of ρ at low level should be approximately 1300 g/m^3, with a wind speed of approximately 2 m/s very near the surface. This is an order of magnitude discrepancy; the expected maximum for very low levels is q $\approx$ 3,000 g/m^2-s at z < 10 mm.
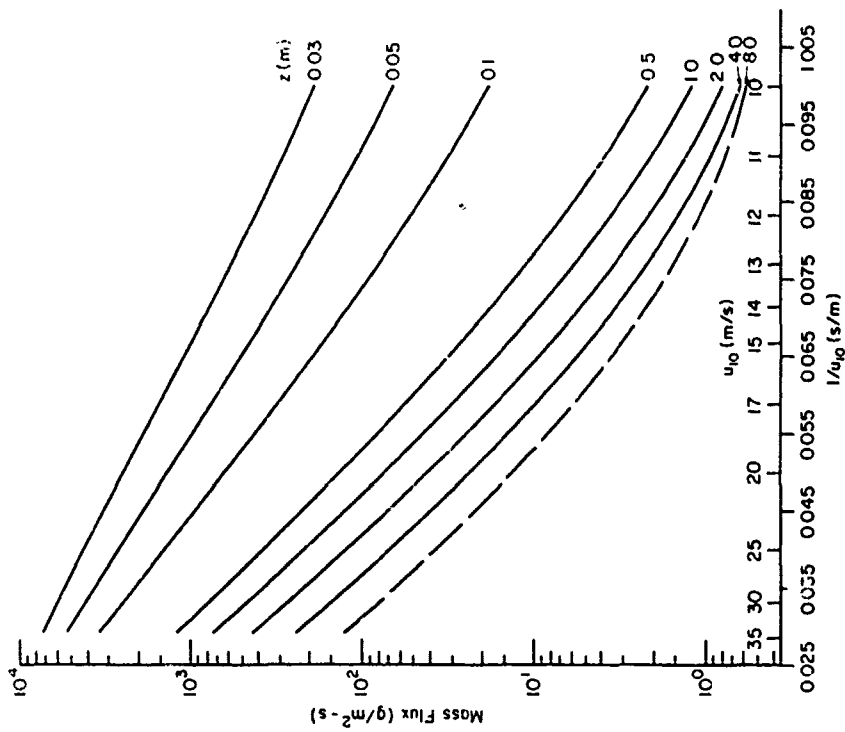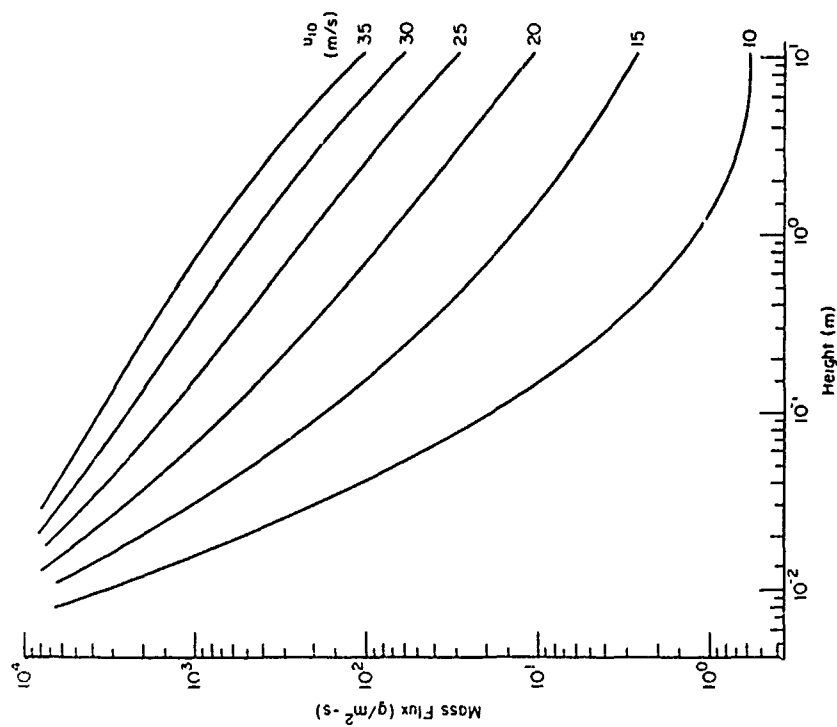
b. q (logarithmic scale) plotted against $1/u_{10}$ (linear scale) and u_{10} (distorted scale), with z as parameter. The line for z = 8 m is broken because the highest measuring level was z = 4 m.

a. q plotted against z on logarithmic scales, with u_{10} as parameter.

Figure 2. Probable values of horizontal mass flux q as a function of height z and wind speed u_{10}.

Figure 2b shows approximate inverse proportionality between $\ln q$ and $1/u_{10}$ at very low levels, but above 0.1 m there is inverse proportionality only in very strong winds. At the higher levels, there appears to be a trend towards a lower limit of q as u_{10} decreases. The indication is that such a limit might be of order 0.1 to 1.0 g/m^2-s, corresponding to the suggested lower limit of ρ around 0.06 g/m^3 if wind speeds are a few metres per second.

. If new measurements should be made in the future, it would be useful to extend the profiles above the 4-m level, since extrapolation to high levels is called for in the treatment of certain problems.

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APPENDIX A: FIELD DATA USED FOR REGRESSION ANALYSIS

Principal data source: Budd et al. (1965).
Additional unpublished data provided by R. Dingle and U. Radok.
Some data for very strong winds from Mellor and Radok (1960).

Height (z)	Wind @ 10 m	Mass Conc	Wind @ z m	Mass Flux	Height (z)	Wind @ 10 m	Mass Conc	Wind @ z m	Mass Flux
4.000	9.60	0.076	8.79	0.668	2.000	12.66	0.564	11.00	6.204
4.000	9.78	0.019	8.95	0.170	2.000	12.68	0.255	11.04	2.815
4.000	10.19	0.111	9.37	1.040	1.000	9.60	0.175	7.52	1.328
4.000	10.73	0.057	9.93	0.566	1.000	9.78	0.037	7.54	0.279
4.000	11.07	0.136	10.28	1.398	1.000	10.19	0.251	8.23	2.066
4.000	11.17	0.219	10.16	2.225	1.000	10.73	0.130	8.59	1.117
4.000	11.21	0.082	10.23	0.839	1.000	11.07	0.264	9.59	2.532
4.000	11.31	0.109	10.33	1.126	1.000	11.17	0.505	8.79	4.439
4.000	11.60	0.104	10.78	1.121	1.000	11.21	0.330	8.90	3.382
4.000	11.64	0.105	10.62	1.115	1.000	11.31	0.385	8.60	3.311
4.000	11.64	0.210	10.75	2.257	1.000	11.60	0.199	9.29	1.849
4.000	11.82	0.046	10.85	0.499	1.000	11.64	0.424	9.24	3.918
4.000	11.87	0.120	10.83	1.300	1.000	11.64	0.691	9.36	6.468
4.000	11.93	0.207	10.85	2.246	1.000	11.82	0.278	9.44	2.624
4.000	11.94	0.103	10.77	1.109	1.000	11.87	0.436	9.56	4.168
4.000	12.08	0.103	10.73	1.105	1.000	11.93	0.362	9.26	3.352
4.000	12.10	0.025	11.18	0.279	1.000	11.94	0.423	9.30	3.934
4.000	12.19	0.150	11.22	1.683	1.000	11.08	0.218	9.21	2.008
4.000	12.26	0.250	11.27	2.818	1.000	12.10	0.205	9.47	1.941
4.000	12.29	0.233	11.28	2.628	1.000	12.19	0.522	9.71	5.069
4.000	12.41	0.050	10.99	0.549	1.000	12.26	0.406	9.69	3.934
4.000	12.41	0.249	11.25	2.801	1.000	12.29	0.348	9.67	3.365
4.000	12.43	0.140	11.42	1.599	1.000	12.41	0.366	9.34	3.418
4.000	12.52	0.045	11.65	0.524	1.000	12.41	0.759	9.62	7.302
4.000	12.56	0.582	11.53	6.710	1.000	12.43	0.484	9.73	4.709
4.000	12.56	0.161	11.70	1.884	1.000	12.52	0.163	10.29	1.677
4.000	12.66	0.264	11.74	3.099	1.000	12.56	0.821	9.74	7.997
4.000	12.68	0.095	11.84	1.125	1.000	12.56	0.553	10.14	5.607
2.000	9.60	0.122	8.43	1.028	1.000	12.66	0.906	10.07	9.123
2.000	9.78	0.031	8.28	0.257	1.000	12.68	0.544	10.05	5.467
2.000	10.19	0.176	8.90	1.566	0.500	9.60	0.331	7.11	2.353
2.000	10.73	0.091	9.17	0.834	0.500	9.78	0.120	6.99	0.839
2.000	11.07	0.230	9.79	2.252	0.500	10.19	0.271	7.61	2.062
2.000	11.17	0.410	9.75	3.997	0.500	10.73	0.354	7.92	2.804
2.000	11.21	0.205	9.61	1.970	0.500	11.07	0.541	8.82	4.772
2.000	11.31	0.236	9.57	2.259	0.500	11.17	0.889	8.32	7.396
2.000	11.60	0.149	10.08	1.502	0.500	11.21	0.791	8.06	6.375
2.000	11.64	0.226	10.11	2.285	0.500	11.31	0.422	7.48	3.157
2.000	11.64	0.336	10.02	3.367	0.500	11.60	0.363	8.77	3.184
2.000	11.82	0.074	10.20	0.755	0.500	11.64	0.855	8.46	7.233
2.000	11.87	0.221	10.19	2.252	0.500	11.64	1.133	8.57	9.710
2.000	11.93	0.223	10.20	2.275	0.500	11.82	0.420	8.69	3.650
2.000	11.94	0.223	10.25	2.286	0.500	11.87	0.861	8.65	7.448
2.000	12.08	0.141	9.94	1.402	0.500	11.93	0.790	8.54	6.747
2.000	12.10	0.068	10.32	0.702	0.500	11.94	0.659	8.44	5.562
2.000	12.19	0.296	10.37	3.070	0.500	12.08	0.590	8.09	4.773
2.000	12.26	0.322	10.40	3.349	0.500	12.10	0.478	8.65	4.135
2.000	12.29	0.286	10.41	2.977	0.500	12.19	1.006	8.88	8.933
2.000	12.41	0.110	10.23	1.125	0.500	12.26	0.566	8.99	5.088
2.000	12.41	0.429	10.53	4.517	0.500	12.29	0.464	8.85	4.106
2.000	12.43	0.241	10.86	2.617	0.500	12.41	0.544	8.26	4.493
2.000	12.52	0.068	10.87	0.739	0.500	12.41	1.151	8.77	10.094
2.000	12.56	0.759	10.93	8.296	0.500	12.43	0.734	9.11	6.687
2.000	12.56	0.275	10.75	2.956	0.500	12.52	0.507	9.76	4.948

Left block:

Height (z)	Wind @ 10 m	Mass Conc	Wind @ z m	Mass Flux
0.500	12.56	1.359	9.10	12.639
0.500	12.56	1.034	9.44	9.761
0.500	12.66	1.629	9.44	15.378
0.500	12.68	0.877	9.66	8.472
0.250	9.60	1.232	6.60	8.131
0.250	9.78	0.221	6.43	1.421
0.250	10.19	0.660	7.08	4.673
0.250	10.73	0.730	7.34	5.358
0.250	11.07	1.172	8.14	9.540
0.250	11.17	1.568	7.45	11.682
0.250	11.21	1.691	7.63	12.902
0.250	11.31	1.012	7.27	7.357
0.250	11.60	0.671	7.97	5.348
0.250	11.64	1.794	7.86	14.101
0.250	11.82	2.180	8.10	17.658
0.250	11.87	0.936	7.98	7.469
0.250	11.93	1.784	7.97	14.218
0.250	11.94	2.535	7.75	19.646
0.250	12.08	1.457	7.77	11.321
0.250	12.10	1.213	7.17	8.697
0.250	12.19	1.329	8.19	10.865
0.250	12.29	2.164	8.28	17.918
0.250	12.41	1.102	8.09	8.915
0.250	12.41	1.203	8.18	9.841
0.250	12.43	1.232	7.37	9.080
0.250	12.52	2.330	7.94	18.500
0.250	12.56	1.789	8.54	15.278
0.250	12.56	1.551	8.83	13.695
0.250	12.66	2.865	8.65	24.782
0.250	12.68	3.689	8.59	31.926
0.125	9.60	1.896	8.84	16.988
0.125	9.78	1.800	8.96	16.782
0.125	10.19	1.477	5.99	8.419
0.125	10.73	2.000	6.48	12.960
0.125	1.07	2.153	6.65	14.317
0.125	11.17	2.089	7.75	37.090
0.125	11.21	2.544	6.84	17.401
0.125	11.31	3.861	6.76	26.100
0.125	11.60	5.056	6.44	32.561
0.125	11.64	2.141	7.43	15.908
0.125	11.64	1.477	7.11	10.782
0.125	11.82	5.527	7.29	39.297
0.125	11.87	4.737	7.29	34.533
0.125	11.93	2.978	7.24	21.710
0.125	11.94	5.040	6.96	36.490
0.125	12.08	4.839	6.92	33.679
0.125	12.10	4.462	6.25	30.877
0.125	12.19	4.312	7.27	26.950
0.125	12.26	5.444	7.27	39.578
0.125	12.29	4.654	7.42	34.533
0.125	12.41	4.875	7.37	35.929
0.125	12.41	4.973	7.27	36.154
0.125	—	6.562	6.33	41.537
0.125	—	5.608	7.11	39.873

Middle block:

Height (z)	Wind @ 10 m	Mass Conc	Wind @ z m	Mass Flux
0.125	12.43	7.182	7.68	47.478
0.125	12.52	4.849	8.26	40.573
0.125	12.56	7.305	7.89	57.636
0.125	12.56	6.543	7.95	52.017
0.125	12.68	7.228	8.01	58.377
0.125	12.68	5.909	8.17	48.277
0.062	9.60	8.084	5.42	43.015
0.062	9.78	6.605	5.05	33.355
0.062	10.19	7.201	5.89	42.414
0.062	10.73	10.088	6.00	60.528
0.062	11.07	11.726	7.16	83.958
0.062	11.17	11.899	6.15	73.179
0.062	11.21	13.290	5.99	79.607
0.062	11.31	30.298	5.67	171.790
0.062	11.60	5.962	6.78	40.422
0.062	11.64	23.073	6.38	147.206
0.062	11.82	14.120	6.57	92.768
0.062	11.87	16.463	6.59	108.491
0.062	11.93	11.785	6.49	76.465
0.062	11.94	21.052	6.18	130.101
0.062	12.08	14.768	6.09	89.937
0.062	12.10	30.330	5.26	159.536
0.062	12.19	18.311	6.50	119.021
0.062	12.26	10.664	6.62	70.596
0.062	12.29	23.221	6.60	153.259
0.062	12.29	29.952	6.50	194.688
0.062	12.41	38.471	5.27	202.742
0.062	12.41	11.911	6.27	74.602
0.062	12.52	18.470	6.93	127.997
0.062	12.56	21.478	7.56	162.374
0.062	12.56	11.635	7.88	91.604
0.062	12.66	18.713	7.28	136.231
0.062	12.66	14.904	7.27	103.352
0.031	9.60	29.162	7.45	217.257
0.031	9.60	34.740	4.65	234.740
0.031	9.76	39.550	4.36	173.229
0.031	10.19	43.110	5.30	228.483
0.031	10.73	60.320	5.36	323.315
0.031	11.07	70.210	6.70	470.407
0.031	11.17	53.360	5.39	291.679
0.031	11.21	56.030	5.36	300.321
0.031	11.31	135.820	4.90	665.518
0.031	11.60	30.270	6.12	185.252
0.031	11.64	103.460	5.67	586.618
0.031	11.64	49.360	5.91	291.716
0.031	11.82	77.290	5.85	452.146
0.031	11.87	32.360	5.77	186.717
0.031	11.93	84.680	5.39	457.503
0.031	11.94	71.410	5.33	380.615
0.031	12.08	121.470	4.41	535.683
0.031	12.10	78.240	5.74	449.090
0.031	12.19	43.640	5.91	257.912
0.031	12.26	99.180	5.83	576.219
0.031	12.29	107.900	5.72	617.188

Right block:

Height (z)	Wind @ 10 m	Mass Conc	Wind @ 2 m	Mass Flux
0.031	12.41	176.690	4.41	779.203
0.031	12.41	57.070	5.43	309.840
0.031	12.43	72.670	6.10	449.101
0.031	12.52	89.360	6.31	617.478
0.031	12.56	51.030	6.41	517.102
0.031	12.56	56.170	6.49	364.543
0.031	12.66	70.860	6.54	463.424
0.031	12.68	102.200	6.74	688.828
4.000	12.70	0.096	11.77	1.130
4.000	12.75	0.128	11.76	1.505
4.000	12.77	0.143	11.84	1.693
4.000	12.84	0.348	11.87	4.131
4.000	12.85	0.158	11.85	1.872
4.000	12.90	0.118	12.00	1.416
4.000	12.96	0.473	11.30	5.581
4.000	12.97	0.167	12.02	2.248
4.000	13.12	0.371	12.07	4.478
4.000	13.21	0.368	12.10	4.453
4.000	13.28	0.185	12.06	2.231
4.000	13.28	0.046	12.16	0.559
4.000	13.39	0.091	12.43	1.131
4.000	13.40	0.437	12.26	5.358
4.000	13.46	0.425	12.26	5.210
4.000	13.58	0.135	12.49	1.656
4.000	13.62	0.392	12.44	4.876
4.000	13.62	0.180	12.57	2.263
4.000	13.66	0.132	12.60	1.690
4.000	13.66	0.224	12.43	2.784
4.000	13.80	0.356	12.54	4.464
4.000	13.81	0.441	12.77	5.632
4.000	13.84	0.310	12.49	3.872
4.000	13.84	0.462	12.69	5.063
4.000	13.93	0.266	12.74	3.369
4.000	13.96	0.308	12.81	3.945
4.000	14.03	0.285	12.39	3.531
4.000	14.03	0.176	12.74	2.242
4.000	14.05	0.217	13.00	2.821
2.000	12.70	0.154	10.94	1.665
2.000	12.75	0.240	10.88	2.611
2.000	12.77	0.334	10.85	3.624
2.000	12.84	0.540	11.15	6.021
2.000	12.85	0.374	10.95	4.095
2.000	12.90	0.253	10.95	2.770
2.000	12.96	0.714	10.99	7.847
2.000	12.97	0.255	11.04	2.815
2.000	13.12	0.546	11.35	6.197
2.000	13.21	0.639	11.45	7.317
2.000	13.28	0.397	11.25	4.466
2.000	13.28	0.103	11.15	1.148
2.000	13.39	0.292	11.49	3.355
2.000	13.40	0.819	11.63	9.525
2.000	13.46	0.554	11.45	6.343
2.000	13.58	0.260	11.74	3.052
2.000	13.62	0.586	11.45	6.710

Group 1 (left)

Height (z)	Wind @10 m	Mass Conc	Wind @2 m	Mass Flux
2.000	13.62	0.288	11.91	3.430
2.000	13.66	0.327	11.93	3.901
2.000	13.66	0.360	11.75	4.230
2.000	13.80	0.717	11.84	8.489
2.000	13.81	0.660	12.01	7.927
2.000	13.84	0.715	11.84	8.466
2.000	13.84	0.612	11.76	7.197
2.000	13.93	0.477	11.77	5.614
2.000	13.96	0.664	11.79	7.229
2.000	14.03	0.567	11.98	6.793
2.000	14.03	0.332	11.86	3.938
2.000	14.05	0.277	12.35	3.421
1.000	12.70	0.278	9.85	2.738
1.000	12.75	0.369	10.02	3.697
1.000	12.77	0.638	10.07	6.425
1.000	12.84	0.867	10.29	8.921
1.000	12.85	0.548	10.26	5.622
1.000	12.90	0.408	10.29	4.198
1.000	12.96	1.764	10.31	18.187
1.000	12.97	0.382	10.28	3.927
1.000	13.12	1.119	10.56	11.817
1.000	13.21	1.316	10.67	14.042
1.000	13.28	0.672	10.43	7.009
1.000	13.28	0.356	10.16	3.617
1.000	13.39	0.574	10.67	6.125
1.000	13.40	1.112	10.37	11.531
1.000	13.46	1.057	10.62	11.225
1.000	13.58	0.497	10.80	5.368
1.000	13.62	1.024	10.63	10.885
1.000	13.62	0.465	10.86	5.050
1.000	13.66	0.695	11.35	7.888
1.000	13.66	0.595	10.90	6.485
1.000	13.80	1.034	10.92	-1.291
1.000	13.81	1.215	10.87	13.207
1.000	13.84	1.341	10.83	14.523
1.000	13.84	1.037	10.70	11.096
1.000	13.93	0.966	10.63	10.481
1.000	15.93	1.182	10.76	12.718
1.000	13.96	1.100	11.26	12.386
1.000	14.03	0.878	10.87	9.544
1.000	14.03	0.445	11.34	5.046
1.000	14.05	0.665	9.30	6.184
0.500	12.70	0.602	9.47	7.595
0.500	12.75	0.951	9.38	12.708
0.500	12.77	1.262	10.07	12.246
0.500	12.84	1.285	9.53	8.920
0.500	12.85	0.951	9.38	6.905
0.500	12.90	0.736	9.49	22.511
0.500	12.96	2.405	9.36	6.735
0.500	12.97	0.706	9.54	15.116
0.500	13.12	1.552	9.74	19.820
0.500	13.21	1.982	10.00	11.230
0.500	13.28	1.171	9.59	6.954
0.500	13.28	0.751	9.26	8.442
0.500	13.39	0.845	9.99	

Group 2 (middle)

Height (z)	Wind @10 m	Mass Conc	Wind @2 m	Mass Flux
0.500	13.40	2.041	9.82	20.003
0.500	13.46	1.877	9.39	18.564
0.500	13.58	0.976	9.38	9.643
0.500	13.62	2.088	9.75	20.358
0.500	13.66	0.672	9.88	6.639
0.500	13.66	2.117	10.50	22.229
0.500	13.80	1.177	10.05	11.829
0.500	13.80	1.800	9.94	17.892
0.500	13.81	2.187	10.23	22.173
0.500	13.84	2.244	10.13	22.732
0.500	13.84	2.397	9.93	23.602
0.500	13.93	1.648	9.96	16.414
0.500	13.96	2.582	10.19	26.311
0.500	14.03	2.207	10.14	22.379
0.500	14.03	1.700	9.94	16.898
0.500	14.05	0.640	10.33	6.611
0.250	12.70	1.451	8.53	12.377
0.250	12.75	2.145	8.52	18.275
0.250	12.77	2.659	9.30	26.589
0.250	12.84	2.405	0.95	21.525
0.250	12.85	2.294	8.69	22.294
0.250	12.90	1.922	8.85	19.935
0.250	12.96	5.284	8.42	44.491
0.250	12.97	1.340	8.80	11.792
0.250	13.12	4.309	9.00	30.701
0.250	13.21	3.089	9.22	34.013
0.250	13.28	2.634	9.76	25.708
0.250	13.28	2.095	8.56	17.933
0.250	13.39	1.528	9.22	14.088
0.250	13.40	3.409	9.12	31.090
0.250	13.46	4.159	8.99	37.389
0.250	13.58	2.676	9.29	24.860
0.250	13.62	1.770	8.69	15.470
0.250	13.62	4.537	8.74	45.325
0.250	13.66	2.538	9.99	23.603
0.250	13.66	3.459	9.30	31.373
0.250	13.80	4.277	9.57	40.931
0.250	13.81	4.740	7.47	44.888
0.250	13.84	4.979	9.08	45.209
0.250	13.93	3.388	9.05	30.661
0.250	13.96	5.873	9.03	53.033
0.250	14.03	4.986	9.45	47.118
0.250	14.05	4.260	8.95	38.127
0.125	12.70	1.098	9.45	10.376
0.125	12.75	5.592	7.73	43.226
0.125	12.77	6.753	7.76	52.403
0.125	12.84	7.352	8.39	61.683
0.125	12.85	7.835	8.12	63.620
0.125	12.90	6.667	7.86	52.403
0.125	12.97	5.628	7.98	44.911
0.125	13.12	10.407	7.66	79.718
0.125	13.21	4.731	7.95	37.611
0.125	13.28	10.517	8.22	86.450

Group 3 (right)

Height (z)	Wind @10 m	Mass Conc	Wind @2 m	Mass Flux
0.125	13.21	12.440	8.26	74.416
0.125	13.28	7.755	8.90	69.079
0.125	13.28	9.760	7.53	45.963
0.125	13.39	5.628	8.38	47.163
0.125	13.40	7.729	8.28	63.996
0.125	13.46	9.380	8.11	76.072
0.125	13.58	6.769	8.50	56.589
0.125	13.62	9.356	7.86	73.538
0.125	13.62	7.177	8.37	70.071
0.125	13.66	6.789	9.20	80.859
0.125	13.66	5.000	8.34	41.700
0.125	13.80	9.026	8.21	74.103
0.125	13.81	13.125	8.64	113.400
0.125	13.84	11.734	8.23	96.571
0.125	13.93	10.122	8.12	82.791
0.125	13.96	9.041	8.01	72.418
0.125	14.03	15.599	8.17	127.444
0.125	14.03	11.540	8.20	94.628
0.125	14.05	10.920	9.02	87.578
0.062	12.70	2.394	8.91	21.331
0.062	12.75	28.393	7.00	198.751
0.062	12.77	19.600	6.97	136.612
0.062	12.84	34.603	6.96	240.837
0.062	12.85	20.465	7.37	150.827
0.062	12.90	22.922	7.07	162.059
0.062	12.96	17.426	7.20	125.467
0.062	12.97	28.439	6.83	194.238
0.062	13.12	19.711	7.16	141.131
0.062	13.28	32.522	7.44	241.964
0.062	13.28	25.114	7.48	177.853
0.062	13.39	26.074	7.03	130.379
0.062	13.28	25.737	6.62	168.173
0.062	13.40	14.252	7.59	197.635
0.062	13.46	12.829	8.39	170.837
0.062	13.58	25.367	7.05	273.167
0.062	13.62	36.229	7.54	170.026
0.062	13.66	24.394	6.97	140.217
0.062	13.62	17.794	7.88	245.420
0.062	13.66	28.907	8.49	81.593
0.062	13.66	11.041	7.39	107.444
0.062	13.80	13.397	8.02	215.011
0.062	13.81	27.495	7.82	170.892
0.062	13.84	24.240	7.05	181.980
0.062	13.93	25.240	7.21	231.104
0.062	13.96	32.874	7.25	273.397
0.062	14.03	37.710	6.90	243.432
0.062	14.05	35.280	6.60	271.590
0.062	14.05	41.150	6.34	49.773
0.031	12.70	5.968	6.15	718.012
0.031	12.75	116.750	6.19	538.963
0.031	12.77	87.070	7.05	1180.170
0.031	12.84	167.400	6.63	614.866
0.031	12.85	92.740	6.28	682.259
		108.640		

Table (page rotated 90°; three column groups). Values as best read from a degraded scan.

Group A

Height (z)	Wind @ 10 m	Mass Conc	Wind @ 2 m	Mass Flux
1.000	16.1?	0.659	12.??	3.250
1.000	16.51	1.945	13.?7	25.737
1.000	16.54	1.621	1?.07	20.862
1.000	16.56	2.771	12.33	34.166
1.000	16.58	1.979	13.27	?.261
1.000	16.78	2.507	12.55	31.463
0.500	14.07	1.304	10.44	13.614
0.500	14.17	1.240	10.38	12.371
0.500	14.23	2.371	10.56	25.-75
0.500	14.29	2.845	10.26	29.190
0.500	14.31	2.761	10.09	27.858
0.500	14.31	1.338	10.96	14.664
0.500	14.41	2.052	10.70	21.956
0.500	14.45	3.255	10.16	33.071
0.500	14.57	2.319	10.73	24.883
0.500	14.59	2.498	10.76	26.771
0.500	14.66	1.514	10.87	16.457
0.500	14.86	4.003	11.22	44.914
0.500	14.89	1.330	10.95	14.563
0.500	15.01	2.217	11.02	24.431
0.500	15.02	1.724	11.13	19.188
0.500	15.29	2.839	10.90	30.945
0.500	15.57	5.386	10.78	58.061
0.500	15.60	3.904	11.31	44.154
0.500	15.69	3.316	11.47	38.035
0.500	15.77	2.409	11.63	28.017
0.500	15.86	3.478	11.70	40.693
0.500	15.91	2.385	11.60	27.666
0.500	16.01	3.253	11.54	37.540
0.500	16.02	4.880	11.72	37.194
0.500	15.13	1.717	11.72	10.123
0.500	16.51	3.869	12.44	98.130
0.500	16.54	3.458	11.80	40.804
0.500	16.56	6.029	11.23	67.706
0.500	16.58	4.281	12.19	52.185
0.500	16.78	6.382	12.55	80.094
0.250	14.07	3.793	9.71	36.830
0.250	14.17	1.765	9.49	16.750
0.250	14.23	5.572	9.63	53.658
0.250	14.29	7.107	9.51	67.588
0.250	14.31	5.228	8.42	44.020
0.250	14.31	4.185	10.11	42.310
0.250	14.41	4.167	9.88	41.170
0.250	14.45	6.802	9.25	62.918
0.250	14.59	5.360	9.76	52.314
0.250	14.59	5.411	10.09	54.597
0.250	14.66	4.186	10.02	41.944
0.250	14.86	8.167	10.45	85.345
0.250	14.89	3.175	10.07	31.972
0.250	15.01	4.975	10.05	49.999
0.250	15.02	4.259	10.25	43.655
0.250	15.29	6.186	9.82	60.747
0.250	15.57	10.778	9.86	106.271
0.250	15.60	8.707	10.36	90.205

Group B

Height (z)	Wind @ 10 m	Mass Conc	Wind @ 2 m	Mass Flux
2.000	14.07	0.123	12.04	1.481
2.000	14.17	0.509	12.42	6.?22
2.000	14.23	0.610	12.27	7.495
2.000	14.29	0.556	12.?8	6.561
2.000	14.31	0.473	12.00	5.676
2.000	14.31	0.112	12.42	1.391
2.000	14.41	0.758	12.38	9.384
2.000	14.45	0.687	12.44	8.546
2.000	14.57	0.675	12.47	8.417
2.000	14.59	0.714	12.44	8.882
2.000	14.66	0.356	12.52	4.457
2.000	14.86	1.087	12.85	13.968
2.000	14.89	0.351	12.85	4.510
2.000	15.01	0.702	12.85	9.021
2.000	15.02	0.561	12.83	7.198
2.000	15.29	0.833	12.74	10.612
2.000	15.57	1.292	13.06	16.874
2.000	15.60	1.011	13.28	13.426
2.000	15.69	1.170	13.44	15.725
2.000	15.77	0.746	13.78	10.280
2.000	15.86	0.909	13.46	12.235
2.000	15.91	0.656	13.64	8.948
2.000	16.01	0.830	13.44	11.155
2.000	16.02	1.315	13.83	18.186
2.000	16.13	0.285	14.07	4.010
2.000	16.51	0.861	14.30	12.312
2.000	16.54	1.088	14.08	15.319
2.000	16.56	1.224	13.78	16.867
2.000	16.58	1.103	14.36	15.839
2.000	16.78	1.382	14.05	19.417
1.000	14.07	0.330	11.36	3.749
1.000	14.17	0.896	11.28	10.107
1.000	14.23	1.113	11.43	2.722
1.000	14.29	1.054	11.23	11.836
1.000	14.31	1.154	10.63	12.267
1.000	14.31	0.432	11.70	5.054
1.000	14.41	1.142	11.40	13.019
1.000	14.45	1.342	11.30	15.165
1.000	14.59	1.117	11.56	12.913
1.000	14.59	1.344	11.60	15.590
1.000	14.66	0.541	11.80	6.384
1.000	14.86	2.095	11.95	25.035
1.000	14.89	0.614	11.97	7.350
1.000	15.01	1.185	11.84	14.030
1.000	15.02	0.819	12.00	9.828
1.000	15.29	1.433	11.58	16.594
1.000	15.57	2.447	11.77	28.801
1.000	15.60	1.774	12.47	22.122
1.000	15.69	1.809	12.42	23.461
1.000	15.77	1.425	12.49	17.798
1.000	15.86	1.870	12.47	23.319
1.000	15.91	1.368	12.72	17.401
1.000	16.01	1.667	12.32	20.537
1.000	16.02	2.399	12.54	30.083

Group C

Height (z)	Wind @ ?? m	Mass Conc	Wind @ 2 m	Mass Flux
0.031	12.90	124.930	6.43	803.100
0.031	1?.?6	105.490	5.99	631.885
0.031	1?.97	65.920	6.37	419.910
0.031	13.12	90.900	6.67	606.303
0.031	13.21	73.970	6.83	505.215
0.031	13.28	87.160	6.85	597.046
0.031	13.28	113.800	5.71	649.798
0.031	13.39	52.590	6.80	357.612
0.031	13.46	47.330	6.66	315.218
0.031	13.58	82.750	6.35	525.463
0.031	13.62	123.080	6.71	625.867
0.031	13.62	111.340	6.04	672.494
0.031	13.66	77.680	6.70	520.456
0.031	13.66	110.270	7.79	859.003
0.031	13.80	43.360	6.66	288.778
0.031	13.81	58.500	6.44	376.740
0.031	13.84	140.750	7.00	985.250
0.031	13.84	90.430	6.45	583.273
0.031	13.93	98.640	6.31	622.418
0.031	13.96	131.130	6.14	805.138
0.031	14.03	165.580	6.34	1049.777
0.031	14.03	135.830	6.35	862.520
0.031	14.05	121.740	6.12	745.049
0.031	14.07	17.660	7.20	127.152
4.000	14.07	0.058	13.05	0.757
4.000	14.17	0.129	13.11	1.691
4.000	14.23	0.371	13.11	4.864
4.000	14.29	0.344	13.08	4.500
4.000	14.31	0.304	12.73	3.870
4.000	14.31	0.063	13.31	0.839
4.000	14.41	0.480	13.14	7.307
4.000	14.45	0.262	13.18	4.481
4.000	14.57	0.566	13.31	5.590
4.000	14.59	0.675	13.60	5.671
4.000	14.66	0.628	13.57	2.633
4.000	14.86	0.545	13.85	7.922
4.000	14.89	0.387	13.61	2.790
4.000	15.01	0.463	13.60	3.890
4.000	15.02	0.307	13.91	3.644
4.000	15.29	0.538	13.91	7.873
4.000	15.57	0.727	14.20	10.592
4.000	15.60	0.114	14.45	1.670
4.000	15.69	0.367	14.40	5.630
4.000	15.77	0.410	14.60	6.105
4.000	15.86	0.600	14.81	9.660
4.000	16.01	0.540	15.10	8.192
4.000	16.78	0.521	14.93	7.779

Left panel

Height (z)	Wind @ 10 m	Mass Conc	Wind @ z m	Mass Flux
0.250	15.69	7.030	10.60	74.518
0.250	15.77	5.356	10.70	57.309
0.250	15.86	7.228	11.02	79.653
0.250	15.91	5.712	10.66	60.890
0.250	16.01	7.235	10.56	76.402
0.250	16.02	11.694	10.54	123.255
0.250	16.13	5.113	10.78	55.118
0.250	16.51	9.875	11.18	110.402
0.250	16.54	14.088	10.41	146.656
0.250	16.56	12.168	10.36	126.060
0.250	16.58	10.398	11.23	116.770
0.250	16.78	14.401	11.18	161.003
0.125	14.07	10.288	8.84	90.946
0.125	14.17	5.569	8.67	48.283
0.125	14.23	14.213	8.90	126.496
0.125	14.29	13.918	8.39	116.772
0.125	14.31	10.128	7.65	77.479
0.125	14.31	13.194	7.34	96.844
0.125	14.41	9.548	8.82	84.213
0.125	14.45	12.079	8.46	102.188
0.125	14.57	14.035	8.92	125.192
0.125	14.59	15.254	9.09	138.659
0.125	14.66	11.847	9.13	108.163
0.125	14.86	20.950	9.54	199.863
0.125	14.89	7.101	9.17	65.116
0.125	15.01	14.379	8.98	129.123
0.125	15.02	11.064	9.32	103.116
0.125	15.57	16.940	8.38	141.957
0.125	15.57	22.391	8.65	193.682
0.125	15.60	17.021	9.40	159.997
0.125	15.69	18.753	9.58	179.654
0.125	15.77	14.064	9.74	136.983
0.125	15.86	13.482	9.66	130.236
0.125	15.91	12.823	9.85	126.307
0.125	16.01	19.907	9.25	184.140
0.125	16.02	24.001	9.59	230.170
0.125	16.13	23.492	9.75	229.047
0.125	16.51	28.784	10.61	305.398
0.125	16.54	28.307	9.44	267.218
0.125	16.56	27.035	8.95	241.963
0.125	16.58	21.000	10.23	214.830
0.125	16.78	36.904	9.98	368.302
0.062	14.07	41.532	8.02	333.087
0.062	14.17	14.971	8.05	120.517
0.062	14.23	46.120	8.09	373.111
0.062	14.29	31.832	7.34	233.647
0.062	14.31	28.441	7.42	211.032
0.062	14.31	40.563	8.56	347.219
0.062	14.41	22.417	7.77	174.180
0.062	14.45	29.905	7.68	229.670
0.062	14.57	33.415	7.81	260.971
0.062	14.59	36.743	8.22	302.027
0.062	14.66	53.194	8.26	439.382
0.062	14.86	44.899	8.69	390.172

Middle panel

Height (z)	Wind @ 10 m	Mass Conc	Wind @ z m	Mass Flux
0.062	14.89	25.728	8.25	212.256
0.062	15.01	34.537	7.39	272.497
0.062	15.02	26.918	8.42	226.650
0.062	15.29	48.411	7.46	361.146
0.062	15.57	60.898	7.55	459.780
0.062	15.60	52.053	7.93	412.780
0.062	15.69	61.942	8.61	533.321
0.062	15.77	40.026	8.78	351.428
0.062	15.86	30.528	8.46	253.267
0.062	15.91	34.100	9.08	309.628
0.062	16.01	50.718	8.01	406.251
0.062	16.02	54.632	8.57	468.196
0.062	16.13	65.261	8.74	570.381
0.062	16.51	75.323	9.67	728.373
0.062	16.54	66.142	8.31	549.640
0.062	16.56	73.018	7.75	565.890
0.062	16.58	53.338	9.22	491.776
0.062	16.78	88.402	7.43	656.827
0.031	14.07	146.110	7.19	1050.531
0.031	14.17	43.750	6.93	303.187
0.031	14.23	113.940	7.21	821.507
0.031	14.29	111.840	6.52	729.197
0.031	14.31	106.120	5.55	588.966
0.031	14.31	153.350	7.27	1114.854
0.031	14.41	83.500	7.05	588.675
0.031	14.45	117.510	6.56	770.866
0.031	14.57	112.650	7.02	792.207
0.031	14.59	88.060	7.35	647.241
0.031	14.66	172.720	7.38	1274.674
0.031	14.86	96.540	7.85	757.839
0.031	14.89	75.810	7.36	557.962
0.031	15.01	144.120	7.07	1018.928
0.031	15.02	95.010	7.51	713.525
0.031	15.29	200.420	6.42	1286.696
0.031	15.57	163.190	6.45	1052.575
0.031	15.60	183.730	7.44	1366.951
0.031	15.69	155.780	7.64	1190.159
0.031	15.77	15.099	7.83	118.225
0.031	15.86	93.830	7.70	722.491
0.031	15.91	130.260	7.93	1032.962
0.031	16.01	203.420	7.11	1446.316
0.031	16.02	169.310	7.56	1279.984
0.031	16.13	227.170	7.77	1765.111
0.031	16.51	249.410	8.74	2179.843
0.031	16.54	219.010	7.19	1574.682
0.031	16.56	241.470	6.55	1581.628
0.031	16.58	167.820	8.22	1379.480
0.031	16.78	251.500	6.15	1546.725
4.000	16.91	0.720	15.83	11.398
4.000	16.94	0.218	15.36	3.348
4.000	17.04	1.195	15.55	18.582
4.000	17.07	0.250	15.71	3.927
4.000	17.11	0.855	15.85	10.552
4.000	17.20	0.746	15.95	11.899

Right panel

Height (z)	Wind @ 10 m	Mass Conc	Wind @ z m	Mass Flux
4.000	17.25	0.353	15.95	5.630
4.000	17.35	0.599	15.59	9.330
4.000	17.48	0.884	15.59	13.782
4.000	17.51	0.452	16.27	7.354
4.000	17.51	0.657	15.82	10.394
4.000	17.72	0.932	16.27	15.164
4.000	17.76	0.967	16.40	15.859
4.000	17.79	0.554	16.28	9.019
4.000	17.92	0.837	16.08	13.459
4.000	17.98	0.619	16.15	9.997
4.000	18.02	0.823	16.04	13.201
4.000	18.20	0.816	16.69	13.619
4.000	18.21	1.071	17.02	18.228
4.000	18.39	0.401	16.60	6.657
4.000	18.42	0.736	16.72	12.306
4.000	18.42	0.739	16.74	12.371
4.000	18.57	0.881	16.79	14.792
4.000	18.65	0.743	17.00	12.631
4.000	18.60	0.847	17.16	14.535
4.000	19.11	0.963	17.36	16.718
4.000	19.39	1.518	17.79	27.005
4.000	19.46	0.636	17.63	11.213
4.000	19.66	0.659	17.99	11.855
4.000	19.81	1.122	18.09	20.297
2.000	16.91	1.383	14.47	20.012
2.000	16.94	0.390	14.42	5.624
2.000	17.04	2.304	14.78	34.053
2.000	17.07	0.689	14.63	10.080
2.000	17.11	1.526	14.61	22.295
2.000	17.20	1.408	14.56	20.500
2.000	17.25	0.791	14.81	11.715
2.000	17.35	1.435	14.80	21.238
2.000	17.48	1.455	14.80	21.534
2.000	17.51	0.927	14.93	13.840
2.000	17.51	1.367	14.93	20.409
2.000	17.72	1.849	15.17	28.049
2.000	17.76	1.745	14.96	26.105
2.000	17.79	1.271	15.09	19.179
2.000	17.92	1.717	14.76	25.343
2.000	17.98	1.060	15.22	16.133
2.000	18.02	1.522	15.10	22.982
2.000	18.20	1.606	15.14	24.315
2.000	18.21	1.862	15.65	29.140
2.000	18.39	0.820	15.71	12.882
2.000	18.42	1.479	15.76	23.309
2.000	18.42	1.347	15.38	20.717
2.000	18.57	1.564	15.77	24.664
2.000	18.65	1.735	16.04	27.829
2.000	18.80	1.574	16.16	25.436
2.000	19.11	2.070	16.37	33.886
2.000	19.39	3.400	16.46	55.964
2.000	19.46	1.238	16.21	20.068
2.000	19.66	1.320	16.43	21.688
2.000	19.81	2.225	16.70	37.157

Panel 1

Height (z)	Wind @ 10 m	Mass Conc	Wind @ z m	Mass Flux
1.000	16.91	2.515	13.49	33.927
1.000	16.94	1.184	13.43	15.901
1.000	17.04	4.468	13.53	60.452
1.000	17.07	1.316	13.71	18.042
1.000	17.11	3.037	13.66	41.485
1.000	17.20	2.665	13.96	36.404
1.000	17.25	1.373	13.30	19.167
1.000	17.35	2.978	13.43	39.607
1.000	17.48	2.798	14.17	37.577
1.000	17.51	1.473	13.64	20.872
1.000	17.51	3.135	14.10	42.761
1.000	17.72	3.708	13.87	52.283
1.000	17.76	3.331	13.67	46.201
1.000	17.79	2.844	13.34	38.877
1.000	17.92	3.706	13.84	49.438
1.000	17.98	1.947	14.08	26.946
1.000	18.02	3.319	13.78	46.732
1.000	18.20	3.264	14.30	44.978
1.000	18.21	3.578	14.44	51.165
1.000	18.39	1.683	14.21	24.303
1.000	18.42	3.017	13.96	42.872
1.000	18.42	2.781	14.59	38.823
1.000	18.57	2.822	14.97	41.173
1.000	18.65	3.134	14.88	46.916
1.000	18.80	3.020	15.05	44.938
1.000	19.11	3.730	15.27	56.136
1.000	19.39	6.471	14.90	98.812
1.000	19.46	2.748	15.35	40.945
1.000	19.66	3.313	15.10	50.855
1.000	19.81	4.740	12.63	71.574
0.500	16.91	5.601	12.22	70.741
0.500	16.94	2.858	12.56	34.925
0.500	17.04	8.781	12.43	110.289
0.500	17.07	2.536	12.98	32.055
0.500	17.11	6.030	13.00	76.099
0.500	17.20	4.930	12.46	73.103
0.500	17.25	5.867	13.34	92.014
0.500	17.35	7.611	12.66	101.531
0.500	17.48	3.743	12.94	47.386
0.500	17.51	6.094	12.40	78.656
0.500	17.72	7.128	13.50	88.387
0.500	17.76	7.153	13.10	96.565
0.500	17.79	3.720	13.03	48.732
0.500	17.92	5.914	13.65	77.059
0.500	17.98	6.733	12.79	86.115
0.500	18.02	6.093	13.65	83.169
0.500	18.21	6.630	13.61	90.234

Panel 2

Height (z)	Wind @ 10 m	Mass Conc	Wind @ z m	Mass Flux
0.500	18.80	6.151	13.64	83.900
0.500	19.11	8.443	13.87	117.104
0.500	19.39	13.294	14.00	186.116
0.500	19.46	5.931	13.83	82.026
0.500	19.66	6.050	13.82	83.611
0.500	19.81	9.921	13.92	138.100
0.250	16.91	11.430	11.54	131.902
0.250	16.94	8.266	10.97	90.678
0.250	17.04	16.482	11.45	188.719
0.250	17.07	5.813	11.56	67.198
0.250	17.11	14.095	11.70	164.911
0.250	17.20	10.714	11.62	124.497
0.250	17.25	7.125	11.88	84.645
0.250	17.35	12.666	10.94	138.785
0.250	17.48	10.207	11.30	115.339
0.250	17.51	7.134	12.07	86.107
0.250	17.51	12.376	11.23	138.982
0.250	17.72	17.221	11.44	197.008
0.250	17.76	16.013	11.70	187.352
0.250	17.79	11.787	11.62	136.965
0.250	17.92	17.171	11.82	202.961
0.250	17.98	9.126	11.49	104.858
0.250	18.02	15.257	11.56	176.371
0.250	18.20	13.343	11.63	155.179
0.250	18.21	15.380	12.30	189.174
0.250	18.39	10.313	12.01	123.859
0.250	18.42	15.289	11.92	182.245
0.250	18.42	17.401	11.80	205.332
0.250	18.57	12.588	12.42	156.343
0.250	18.65	14.611	12.44	181.761
0.250	18.80	13.956	12.51	174.590
0.250	19.11	19.678	12.69	249.714
0.250	19.39	26.268	12.81	315.493
0.250	19.46	17.433	12.54	218.610
0.250	19.66	14.168	12.66	179.367
0.250	19.81	22.125	12.55	277.669
0.125	16.91	20.558	10.65	218.943
0.125	16.94	18.864	9.97	188.074
0.125	17.04	37.033	10.45	386.995
0.125	17.07	13.929	10.56	147.090
0.125	17.11	24.151	10.60	256.001
0.125	17.20	22.179	10.53	233.545
0.125	17.25	14.706	10.86	159.707
0.125	17.35	29.119	10.90	317.397
0.125	17.48	24.256	9.79	237.466
0.125	17.51	30.899	11.01	340.198
0.125	17.51	29.703	10.08	299.406
0.125	17.72	30.149	10.80	325.609
0.125	17.76	32.898	10.58	348.061
0.125	17.79	36.731	10.24	376.125
0.125	17.92	40.607	10.64	432.058
0.125	17.98	26.737	10.11	270.311
0.125	18.02	33.728	10.03	336.292
0.125	18.20	40.139	10.07	404.200

Panel 3

Height (z)	Wind @ 10 m	Mass Conc	Wind @ z m	Mass Flux
0.125	18.21	27.526	10.12	449.330
0.125	18.19	25.691	10.12	271.105
0.125	18.42	32.057	10.63	340.766
0.125	18.42	34.794	10.26	358.771
0.125	18.57	40.048	10.39	440.127
0.125	18.55	24.294	11.35	274.715
0.125	18.80	29.562	11.32	339.170
0.125	19.11	38.084	11.38	433.396
0.125	19.39	55.945	11.54	645.605
0.125	19.46	33.078	10.93	361.543
0.125	19.62	33.624	11.27	378.942
0.125	19.81	55.037	11.20	616.414
0.062	16.91	47.530	9.79	465.319
0.062	16.94	66.010	8.86	584.849
0.062	17.04	71.910	9.41	676.673
0.062	17.07	29.980	9.53	285.709
0.062	17.11	88.930	9.57	851.060
0.062	17.20	51.690	9.67	499.842
0.062	17.25	41.630	9.86	410.472
0.062	17.35	82.430	8.53	703.128
0.062	17.48	66.480	8.28	550.454
0.062	17.51	75.970	9.99	758.940
0.062	17.51	72.580	8.88	644.510
0.062	17.72	76.360	8.81	672.731
0.062	17.76	83.310	9.44	786.446
0.062	17.79	77.000	9.04	696.080
0.062	17.92	74.060	7.80	577.668
0.062	17.98	76.410	8.72	566.295
0.062	18.02	62.460	8.60	537.156
0.062	18.20	97.060	8.78	842.187
0.062	18.21	56.900	10.41	592.329
0.062	18.39	76.250	9.84	7-0.300
0.062	18.42	86.530	9.40	813.382
0.062	18.42	88.430	8.97	743.217
0.062	18.57	84.480	9.51	803.405
0.031	16.91	101.720	8.67	881.912
0.031	16.94	227.150	7.77	1764.955
0.031	17.04	182.740	8.36	1527.706
0.031	17.07	107.200	8.51	912.272
0.031	17.11	194.450	8.54	1575.203
0.031	17.20	130.010	8.42	1094.684
0.031	17.25	102.910	8.66	911.783
0.031	17.35	170.690	7.01	1197.939
0.031	17.48	181.780	7.35	1336.083
0.031	17.51	219.920	8.96	1970.483
0.031	17.51	213.310	7.72	1646.753
0.031	17.72	257.870	8.61	2220.261

Height (z)	Wind @ 10 m	Mass Conc	Wind @ z m	Mass Flux
0.031	17.76	216.180	8.31	1796.456
0.031	17.79	190.230	7.85	1493.305
0.031	17.92	277.290	6.42	1780.202
0.031	17.98	198.470	7.63	1514.326
0.031	18.02	233.880	7.62	1782.166
0.031	18.20	298.660	7.50	2239.950
0.031	18.21	148.660	9.15	1360.239
0.031	18.39	235.310	8.43	1983.663
0.031	18.42	264.940	8.16	2161.910
0.031	18.42	262.050	7.68	2012.544
0.031	18.57	300.630	8.59	2582.412
0.031	18.65	139.100	9.04	1257.464
0.031	18.80	173.860	8.96	1557.785
0.031	19.11	233.600	8.94	2088.384
0.031	19.39	227.530	9.06	2061.421
0.031	19.46	338.060	8.23	2782.233
0.031	19.66	475.160	8.62	4095.879
0.031	19.81	355.920	8.47	3014.642
4.000	20.17	0.973	18.36	17.864
4.000	20.95	1.870	19.12	35.754
4.000	20.96	1.574	19.30	30.378
4.000	22.08	1.950	20.06	39.117
4.000	22.13	2.335	20.20	47.167
4.000	22.20	2.242	19.85	44.504
4.000	22.43	1.432	20.29	29.055
4.000	22.62	1.944	20.87	40.571
4.000	22.88	1.783	20.78	37.051
4.000	23.51	2.828	21.57	61.000
4.000	23.94	2.861	21.87	62.570
4.000	24.02	2.782	21.82	60.703
2.000	20.17	1.572	17.32	27.227
2.000	20.95	4.017	18.09	72.668
2.000	20.96	3.279	18.08	59.284
2.000	22.08	3.244	18.68	60.598
2.000	22.13	4.947	18.77	92.855
2.000	22.20	4.029	18.62	75.020
2.000	22.43	2.503	18.73	46.881
2.000	22.62	3.210	19.59	62.884
2.000	22.88	3.511	19.36	67.973
2.000	23.51	6.185	19.83	122.649
2.000	23.94	6.686	20.23	135.258
2.000	24.02	5.279	20.00	105.580
1.000	20.17	3.261	15.84	51.654
1.000	20.95	7.454	16.53	123.215
1.000	20.96	6.101	16.62	101.399
1.000	22.08	7.164	17.48	125.227
1.000	22.13	9.947	17.27	171.785
1.000	22.20	7.507	16.79	126.043
1.000	22.43	5.715	17.26	98.641
1.000	22.62	7.009	17.68	123.919
1.000	22.88	6.603	17.30	114.232
1.000	23.51	11.038	18.21	201.002
1.000	23.94	10.367	18.28	189.509
1.000	24.02	10.881	18.57	202.060

Height (z)	Wind @ 10 m	Mass Conc	Wind @ z m	Mass Flux
0.500	20.17	6.873	14.36	98.696
0.500	20.95	14.799	15.07	223.021
0.500	20.96	11.577	15.16	175.507
0.500	22.08	15.298	15.69	240.026
0.500	22.13	19.601	15.85	310.676
0.500	22.20	16.199	15.06	243.957
0.500	22.43	11.627	16.25	188.939
0.500	22.62	11.943	16.48	196.821
0.500	22.88	13.579	15.79	214.412
0.500	23.51	21.115	16.59	350.298
0.500	23.94	19.057	16.75	319.205
0.500	24.02	21.644	16.60	359.290
0.250	20.17	15.010	13.33	200.083
0.250	20.95	29.170	14.04	409.547
0.250	20.96	23.880	14.36	342.917
0.250	22.08	32.060	14.27	457.496
0.250	22.13	42.090	14.18	596.836
0.250	22.20	36.000	13.43	483.480
0.250	22.43	28.860	14.21	410.101
0.250	22.62	24.400	15.50	378.200
0.250	22.88	30.030	14.55	436.936
0.250	23.51	41.350	15.37	635.549
0.250	23.94	38.100	15.45	588.645
0.250	24.02	44.340	15.09	669.090
0.125	20.17	38.080	11.94	454.675
0.125	20.95	58.630	12.62	739.911
0.125	20.96	44.390	12.86	570.855
0.125	22.08	62.550	12.87	805.019
0.125	22.13	69.070	12.89	890.312
0.125	22.20	63.590	11.83	752.270
0.125	22.43	80.050	12.37	990.219
0.125	22.62	70.790	13.87	981.857
0.125	22.88	89.070	12.78	1138.315
0.125	23.51	72.700	13.62	990.174
0.125	23.94	76.170	13.62	1037.435
0.125	24.02	80.300	13.36	1072.808
0.062	20.17	89.110	9.31	829.614
0.062	20.95	145.560	11.30	1644.828
0.062	20.96	99.480	11.58	1151.978
0.062	22.08	141.400	11.41	1613.374
0.062	22.13	126.430	11.51	1455.209
0.062	22.20	160.430	10.19	1634.781
0.062	22.43	168.410	9.22	1552.740
0.062	22.62	131.300	12.48	1638.624
0.062	22.88	189.220	9.57	1810.835
0.062	23.51	136.430	12.06	1645.345
0.062	23.94	198.890	11.99	2384.691
0.062	24.02	151.530	11.67	1768.355
0.031	20.17	310.310	9.33	2895.192
0.031	20.95	365.630	9.98	3648.987
0.031	20.96	365.450	10.30	3764.135
0.031	22.08	406.340	9.95	4043.083
0.031	22.13	299.290	9.96	2980.928
0.031	22.20	382.750	8.55	3272.512

Height (z)	Wind @ 10 m	Mass Conc	Wind @ z m	Mass Flux
0.031	22.43	371.510	9.95	3696.524
0.031	22.62	276.900	11.10	3073.590
0.031	22.88	543.700	9.64	5241.267
0.031	23.51	505.410	10.49	5301.750
0.031	23.94	544.590	10.36	5641.952
0.031	24.02	348.970	9.97	3479.230
4.000	20.13	2.461	18.55	45.652
4.000	14.74	0.428	13.76	5.889
4.000	22.94	2.030	21.49	43.625
4.000	21.69	6.670	20.00	133.400
4.000	26.89	11.250	25.00	281.250
4.000	29.23	10.410	27.34	284.609
4.000	20.91	1.890	19.22	36.326
4.000	24.28	4.020	22.31	89.686
4.000	24.60	3.520	22.91	80.643
4.000	23.27	2.220	21.97	48.773
4.000	26.27	6.490	24.92	161.731
4.000	27.75	4.460	25.78	114.979
4.000	21.95	1.270	19.97	25.362
4.000	16.68	0.293	15.49	4.539
4.000	24.04	2.361	22.43	52.957
4.000	23.07	0.771	21.73	16.754
4.000	25.44	2.990	23.88	71.401
4.000	18.22	0.262	17.28	4.527
2.000	20.13	4.142	17.31	71.698
2.000	14.74	6.599	11.82	78.000
2.000	22.94	4.540	20.48	92.979
2.000	21.69	10.160	18.90	192.024
2.000	26.89	17.350	23.69	411.021
2.000	29.23	13.310	26.00	346.060
2.000	20.91	3.520	18.18	63.994
2.000	24.28	6.680	20.96	140.013
2.000	24.60	7.420	21.70	161.014
2.000	23.27	3.740	21.12	78.989
2.000	26.27	9.230	24.27	224.012
2.000	27.75	7.540	24.40	183.976
2.000	21.95	3.830	18.62	71.315
2.000	16.68	0.524	14.81	7.760
2.000	24.04	4.730	21.56	101.979
2.000	23.07	2.267	20.16	45.703
2.000	25.44	4.180	22.92	95.806
2.000	18.22	0.464	16.72	7.758
1.000	20.13	6.609	16.06	106.141
1.000	14.74	1.261	12.31	15.523
1.000	22.94	5.010	19.55	97.945
1.000	21.69	14.710	17.88	263.015
1.000	26.89	23.170	22.44	519.935
1.000	29.23	22.570	24.69	557.253
1.000	20.91	6.450	17.26	111.327
1.000	24.28	11.610	19.74	229.181
1.000	24.60	11.530	20.56	237.057
1.000	23.27	6.180	20.31	125.516
1.000	26.27	12.300	23.83	293.109
1.000	27.75	13.320	23.10	307.692

Table 1 (top right)

Height (z)	Wind @ 10 m	Mass Conc	Wind @ z m	Mass Flux
1.000	25.00	15.200	18.00	273.600
1.000	33.00	15.900	23.80	378.420
1.000	36.00	13.500	25.90	349.650
0.500	23.00	3.580	15.00	53.700
0.500	24.00	7.300	15.70	114.610
0.500	25.00	19.750	16.30	321.925
0.500	33.00	18.700	21.60	403.920
0.500	36.00	17.400	23.50	408.900
0.040	23.00	17.050	10.50	179.025
0.040	24.00	53.100	10.90	578.790
0.040	25.00	136.600	11.40	1557.240
0.040	33.00	126.000	15.20	1915.200
0.040	36.00	88.800	16.40	1456.320

Table 2 (middle)

Height (z)	Wind @ 10 m	Mass Conc	Wind @ z m	Mass Flux
0.120	21.95	82.750	12.93	1069.958
0.120	16.68	50.870	11.56	588.057
0.120	24.04	104.700	17.13	1793.511
0.120	23.07	48.320	17.59	849.949
0.120	25.44	54.700	18.61	1017.967
0.120	18.22	22.700	14.23	323.021
0.060	20.13	99.380	11.24	1117.031
0.060	14.74	33.400	9.34	311.956
0.060	22.94	96.980	15.22	1476.035
0.060	21.69	328.400	12.85	4219.940
0.060	26.89	234.500	16.80	3939.600
0.060	29.23	207.800	19.02	3819.216
0.060	20.91	207.800	12.27	2549.706
0.060	24.28	389.600	13.86	5399.855
0.060	24.60	189.400	15.47	2930.018
0.060	23.27	58.990	16.46	970.975
0.060	26.27	134.700	19.97	2689.959
0.060	27.75	272.900	17.22	4699.338
0.060	21.95	204.400	11.50	2350.600
0.060	16.68	150.700	10.75	1620.025
0.060	24.04	320.700	16.03	5140.820
0.060	23.07	120.500	16.72	2014.760
0.060	25.44	94.900	17.63	1673.087
0.060	18.22	50.300	13.56	682.068
0.030	20.13	183.900	10.02	1842.678
0.030	14.74	60.230	8.60	517.978
0.030	22.94	178.000	14.16	2520.479
0.030	21.69	405.500	11.64	4720.020
0.030	26.89	437.700	15.42	6749.334
0.030	29.23	536.900	17.60	9449.439
0.030	20.91	391.300	11.09	4339.517
0.030	24.28	822.900	12.42	10220.418
0.030	24.60	254.900	14.22	3624.678
0.030	23.27	103.500	15.54	1608.390
0.030	26.27	145.500	19.11	2780.505
0.030	27.75	465.800	15.78	7350.323
0.030	21.95	353.500	10.07	3559.745
0.030	16.68	251.800	9.94	2502.892
0.030	24.04	673.600	14.93	10059.834
0.030	23.07	185.600	15.05	2944.930
0.030	25.44	137.100	16.45	2255.295
0.030	18.22	91.700	12.92	1184.764
4.000	23.00	1.500	20.20	30.300
4.000	24.00	3.430	21.00	72.030
4.000	25.00	8.610	21.90	188.559
4.000	33.00	11.500	28.90	332.350
4.000	36.00	8.220	31.60	259.752
2.000	23.00	1.060	18.30	34.038
2.000	24.00	4.160	19.10	79.456
2.000	25.00	12.550	19.90	249.745
2.000	33.00	13.550	26.30	356.365
2.000	36.00	11.120	28.60	318.032
1.000	23.00	2.060	16.60	47.476
1.000	24.00	5.930	17.30	102.569

Table 3 (bottom left)

Height (z)	Wind @ 10 m	Mass Conc	Wind @ z m	Mass Flux
1.000	21.95	5.980	17.40	104.052
1.000	16.68	1.300	14.22	18.486
1.000	24.04	7.091	20.78	147.351
1.000	23.07	2.333	20.58	48.013
1.000	25.44	5.850	22.12	129.402
1.000	18.22	0.567	16.31	9.248
0.500	20.13	11.660	14.89	173.617
0.500	14.74	1.974	11.55	22.800
0.500	22.94	7.780	18.38	142.996
0.500	21.69	23.500	16.47	387.045
0.500	26.89	32.220	23.53	758.136
0.500	29.23	33.980	23.19	787.996
0.500	20.91	10.120	15.81	159.997
0.500	24.28	22.120	18.31	405.017
0.500	24.60	19.680	19.21	378.053
0.500	23.27	10.910	19.25	210.017
0.500	26.27	20.130	22.55	453.931
0.500	27.75	23.590	21.53	507.893
0.500	21.95	13.120	15.78	207.034
0.500	16.68	3.360	13.18	44.285
0.500	24.04	14.110	18.21	256.943
0.500	23.07	4.017	19.32	77.608
0.500	25.44	10.700	20.09	214.963
0.500	18.22	0.975	15.49	15.103
0.250	20.13	24.470	13.69	334.994
0.250	14.74	6.041	10.81	65.303
0.250	22.94	20.890	17.27	360.770
0.250	21.69	50.720	15.17	769.422
0.250	26.89	66.650	19.49	1299.008
0.250	29.23	70.240	21.75	1527.720
0.250	20.91	28.020	14.50	406.290
0.250	24.28	50.180	16.61	833.490
0.250	24.60	45.490	17.92	815.181
0.250	23.27	22.710	18.25	414.457
0.250	26.27	37.900	21.48	814.092
0.250	27.75	47.290	20.03	947.219
0.250	21.95	29.480	14.26	420.305
0.250	16.68	7.750	12.25	94.937
0.250	24.04	25.450	18.04	459.118
0.250	23.07	15.010	18.26	274.083
0.250	25.44	20.000	19.56	391.200
0.250	18.22	5.440	14.74	80.186
0.120	20.13	43.420	12.46	541.013
0.120	14.74	10.220	10.08	103.018
0.120	22.94	58.270	16.27	948.053
0.120	21.69	125.200	14.06	1760.312
0.120	26.89	113.900	18.17	2069.562
0.120	29.23	93.580	20.41	1909.968
0.120	20.91	69.520	13.45	935.044
0.120	24.28	138.800	15.27	2119.476
0.120	24.60	125.000	16.72	2090.000
0.120	23.27	33.980	17.39	590.912
0.120	26.27	56.550	20.83	1177.937
0.120	27.75	115.000	18.65	2144.750